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**Two ensign wasps in Cretaceous amber from New Jersey and Myanmar
(Hymenoptera: Evaniidae)**

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ABSTRACT. The remains of two new ensign wasps (Hypsosomata: Evanoidea: Evaniidae) are described and figured from individuals preserved in Cretaceous amber. *Grimaldivania mckimorum* sp. n. is described in Late Cretaceous (Turonian) amber from New Jersey. This is the second species of *Grimaldivania* and is distinguished from *G. ackermani* BASIBUYUK, FITTON & RASNITSYN by wing venation and structure of the antenna. *Sorellevania deansi* gen. et sp. n. is described in middle Cretaceous (latest Albian) amber from northern Myanmar (Burma). *Sorellevania* is the second genus of ensign wasps recognized from Burmese amber. The geological history of the Evanoidea is briefly reviewed, with the subfamily Hyptiogastritinae subf. n. (Evanoidea: Aulacidae) established.

KEY WORDS: Evaniomorpha, Albian, Turonian, Mesozoic, palaeontology, taxonomy.

INTRODUCTION

Ensign wasps (family Evaniidae) are distinctive apocritans predatory on the eggs of roach oöthecae. The family comprises 436 modern species in 20 extant genera (DEANS 2005). Several species have been described from Mesozoic ambers ranging from the Early to Late Cretaceous (e.g., RASNITSYN 1975; BASIBUYUK et al. 2000a, 2000b, 2002; ALONSO et al. 2000; DEANS et al. 2004; ENGEL & GRIMALDI unpubl. data), in addition to relatively modern species in Tertiary ambers (e.g., BRUES 1933; WEITSCHAT & WICHARD 2002; NEL et al. 2002a, 2002b; SAWONIEWICZ & KUPRYJANOWICZ 2003; ENGEL 2004, pers. obs.).

Herein I provide the description of two new species of ensign wasps in Cretaceous amber. The first species is a representative of the genus *Grimaldivania* in Late Cretaceous amber from New Jersey's Raritan Formation. The dating of the New Jersey deposit is dis-

cussed by GRIMALDI et al. (2000). The second species is of a new genus and species and was discovered in middle Cretaceous amber from northern Myanmar (Burma). The dating of the Burmese amber has been summarized by ZHERIKHIN & ROSS (2000), GRIMALDI et al. (2002), CRUIKSHANK & KO (2003), and GRIMALDI & ENGEL (2005). Morphological terminology generally follows that of GOULET & HUBER (1993). The biology and geological history of the family is summarized by GRIMALDI & ENGEL (2005), while DEANS & HUBEN (2003) provide a key to the modern genera.

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SYSTEMATIC PALAEONTOLOGY

Infraorder: Evaniomorpha RASNITSYN 1980

Parvorder: Hypsisomata ENGEL 2005

Superfamily: Evanioidea LATREILLE 1802

Family: Evaniiidae LATREILLE 1802

Genus: *Grimaldivania* BASIBUYUK, FITTON & RASNITSYN In BASIBUYUK et al. 2000a

Grimaldivania mckimorum sp. n.

(Fig. 1)

Diagnosis

The new species is similar to the male of *Grimaldivania ackermani* BASIBUYUK, FITTON & RASNITSYN as described in BASIBUYUK et al. (2000a): e.g., 1m-cu entering first submarginal cell and slightly arched toward wing apex; marginal cell relatively short, with distal abscissa of Rs strongly arched; 2cu-a extremely short, nearly absent; first submarginal cell longer than first discoidal cell; petiole shorter than mesoscutellum). *Grimaldivania mckimorum*, however, differs in the smaller body size, the first flagellar article is as long as the second flagellar article (first flagellar article longer than succeeding articles in *G. ackermani*), meoscutellum not arching over and obscuring metanotum, and the second submarginal cell is absent (*i.e.*, 1rs-m is absent, even as a nebulous vein in the new species; 1rs-m is present as a spectral or nebulous vein in *G. ackermani*).



Fig. 1. Lateral aspect of holotype of *Grimaldivania mckimorum* sp. n. (AMNH) in Turonian amber from New Jersey.

Description

♂: Generally as described for *G. ackermani* (BASIBUYUK et al. 2000a) except as follows: Total body length, including petiole and gaster ca. 1.72 mm; forewing length 1.25 mm. Head slightly wider than mesosoma; flagellar articles about as long as wide, except first three flagellar articles slightly longer than wide and of equal lengths, remaining flagellar articles shorter; occipital carina present. Mesoscutellum relatively low, slightly and gently arched, not arching over or obscuring metanotum; notaui distinctly impressed. Forewing marginal cell 1.5 times longer than pterostigma, with distal abscissa of Rs curving evenly beyond submarginal cell; 1rs-m absent (i.e., only a single submarginal cell present). Petiole distinctly shorter than mesoscutellar length, petiolar length approximately 1.4 times greater than width; gaster ovoid, longer than high.

Holotype

Holotype ♂ depicted in Fig. 1; AMNH; New Jersey: Middlesex County, Sayreville, White Oaks pits (Raritan Formation: Turonian), K. McKim coll. The holotype is in the Amber Fossil Collection, Division of Invertebrate Zoölogy, American Museum of Natural History, New York. The holotype is preserved along with the remains of a moth, leafhopper, stigmaphronid wasp (to be described elsewhere: ENGEL & GRIMALDI in prep.), and partial specimens of other parasitic Microhymenoptera.

Etymology

The specific epithet is a patronymic honouring the family of Ken McKim who discovered and donated this valuable amber piece to the amber collection of the American Museum of Natural History.

Sorellevania* gen. n.*Type species**

Sorellevania deansi sp. n.

Diagnosis

Female fully winged and of small body size (total body length approximately 1.4 mm); head slightly wider than long, with broad vertex; ocelli present; compound eyes relatively small, length less than one-half head length; ocular sulcus present and complete; malar space slightly longer than basal mandibular width; clypeus swollen medially and distinctly elevated above plane of face; gena narrower than maximum width of compound eye; antenna elbowed, articulated above level of head midlength, not inserted on swelling or shelf; weak ridge present immediately behind antennal insertion; scape elongate, about as long as head; pedicel slightly longer than wide, shorter than first flagellar article; flagellar articles each longer than wide, first and distalmost flagellar articles longest; 13 flagellar articles in total; occipital carina present and complete. Mesosoma strongly sclerotized, compact and relatively high; pronotum without distinct dorsal surface, collar distinct; propodeum areolate posteriorly and dorsally, laterally with relatively regular dorsoventral areolae; propodeum not rising toward articulation with petiole. Forewing venation relatively complete, with seven cells enclosed by tubular veins; pterostigma elongate and narrow; marginal cell triangular, length more than twice maximal width; distal abscissa of R₁ continuing along anterior wing margin to wing apex; jugal lobe absent; distal abscissa of R_s straight, terminating on anterior margin of wing well before wing apex; first submarginal cell relatively short and quadrate; 1rs-m present; 2rs-m absent; 1m-cu present; 2m-cu absent; M with short distal abscissa extending beyond second submarginal cell for distance slightly greater than length of second submarginal cell. Hind wing with two distal hamuli, without venation

except Sc+R, without jugal lobe. Legs elongate; tarsi pentamerous; pretarsal claws short, slender, simple; arolium present. Petiole length slightly less than one-half gaster length; gaster ovoid; ovipositor thin, exposed, length greater than gastral height.

Comments

The genus can be distinguished from the only other evaniid presently known in Burmese amber, *Mesevania swinhoei* BASIBUYUK & RASNITSYN (In BASIBUYUK et al. 2000b), by the elbowed antenna (not elbowed in *Mesevania*), the elongate scape (scape shorter than first flagellar article in *Mesevania*), the smaller number of flagellar articles (more than 15 flagellar articles in *Mesevania*), the swollen clypeus (clypeus flat in *Mesevania*), the absence of 2rs-m (1rs-m and 2rs-m both tubular and pigmented in *Mesevania*: termed 2rs-m and 3rs-m by BASIBUYUK et al. 2000b), the smaller marginal cell (large, with marginal cell apex near wing apex in *Mesevania*), hind wing without venation (hind wing with R and M+Cu present in *Mesevania*), and the absence of the putative metatibial “organ” (apparently present in *Mesevania* but this feature may be an artefact of preservation as the holotype of *M. swinhoei* is greatly compressed). In all of these features *Sorellevania* is more similar to typical Evaniiidae than *Mesevania*.

From other genera of Cretaceous amber ensign wasps *Sorellevania* can be separated by some of the following: from *Protoparevania*, *Eovernevania*, *Lebanevania*, *Grimaldivania*, and *Newjersevania* by the more elongate scape (scapes vary in length among these genera but in all the scape is distinctly shorter than the head length); from *Protoparevania* and *Eovernevania* by the presence of 1rs-m; from *Grimaldivania* and *Newjersevania* by 1rs-m being tubular rather than nebulous; from *Grimaldivania* and *Protoparevania* by the more elongate and straight marginal cell; from *Grimaldivania* and *Eovernevania* by the shorter and more quadrate first submarginal cell; and from all of these genera by the swollen clypeus, ridge dorsal to antennal insertion, and small compound eyes.

Etymology

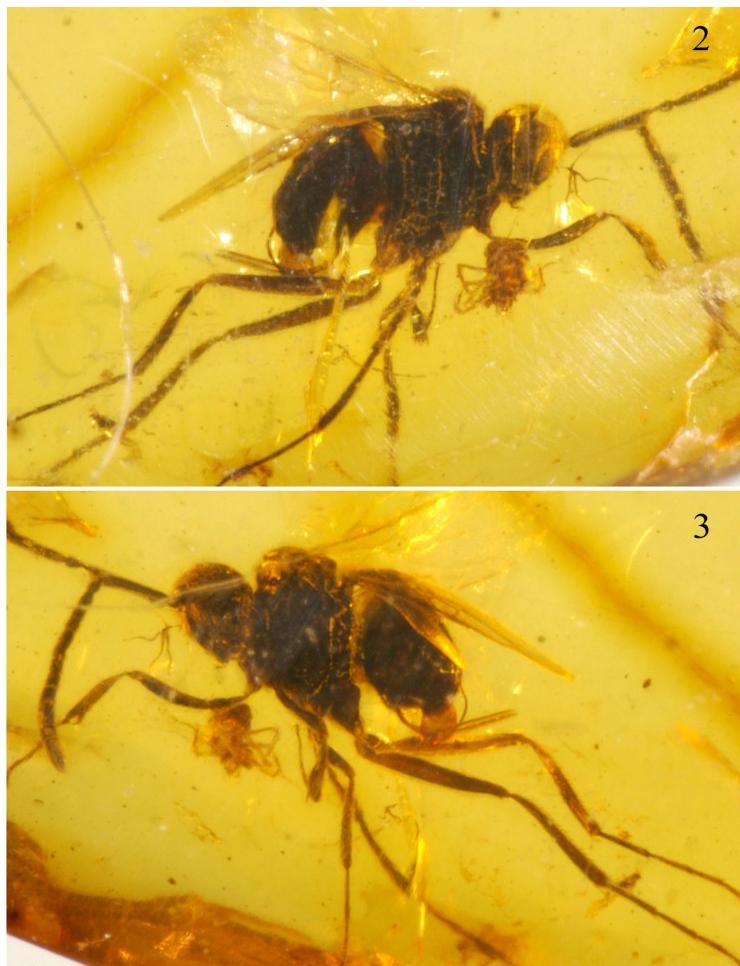
The new genus-group name is a combination of *sorelle* (Greek meaning, “old person”) and *Evania* (type genus of the family). The name is feminine.

Sorellevania deansi sp. n.

(Figs 2–4)

Diagnosis

As for the genus (*vide supra*).



Figs 2-3. *Sorellevania deansi* gen. et sp. n. (KU-NHM-ENT, Bu-058) in latest Albian amber from Myanmar. 2 – right lateral habitus of holotype, 3 – left lateral habitus of holotype.

Description

♀: As for the genus, with the following additions: Length from front of head to posterior border of propodeum 0.66 mm. Integument of head, mesosoma, and metasoma black; antenna beyond pedicel, tegula, legs, and ovipositor dark brown; wing veins light brown; membrane hyaline; integument generally faintly imbricate except upper gena and vertex

weakly rugulose; mesosomal sculpturing as noted in generic diagnosis except faintly imbricate where not areolate and apparently with scattered, faint, minute punctures on mesoscutum. Head wider than long, with compound eyes in lower portion of head, well separated from vertex and ocelli (separated by distance nearly equal to compound eye length, a notable apomorphy for the genus and species); scape elongate, 0.33 mm in length; flagellar articles becoming slightly thicker from basal to apical; apicalmost flagellar article tapered to acutely-rounded apex; antenna evenly covered with minute, erect, simple, white setae, setae not obscuring integumental surface; setae of head scattered, suberect, and white. Mesosomal height 0.6 mm; mesoscutum slightly arching above level of head in lateral aspect giving species a slightly “hunchbacked” appearance; direct dorsal view of specimen not possible and thus presence/absence of notaui and parapsidal lines indeterminate; mesoscutellum strongly arched, with distinct angle between dorsal-facing and posterior-facing surfaces, two surfaces subequal in length; metanotum apparently exceedingly short; setae of mesoscutum short, evenly-distributed, suberect, and white, setae elsewhere on mesosoma sparse, although those ventrally on mesopleura and near legs slightly longer and more numerous. Forewing 1.17 mm in length; hind wing 0.68 mm in length, with two distal hamuli; wings with relatively numerous, suberect, white setae. Legs faintly imbricate, with scattered, short, off-white to pale brown setae. Petiole 0.22 mm in length, 0.05 mm in width; gastral length 0.52 mm, height 0.38 mm; setae exceedingly sparse except on ovipositor sheaths.

Holotype

Holotype ♀ depicted in Figs. 2-3; KU-NHM-ENT, Bu-058; Myanmar, Kachin, Tanai Village (on Ledo Rd. 105km northwest of Myitkyna); latest Albian. The holotype is in the Fossil Insect Collection, Division of Entomology, University of Kansas Natural History Museum, Lawrence, Kansas.

Etymology

The specific epithet is a patronymic honouring Dr. Andrew R. DEANS who has laudably revived critical study of evaniid systematics.

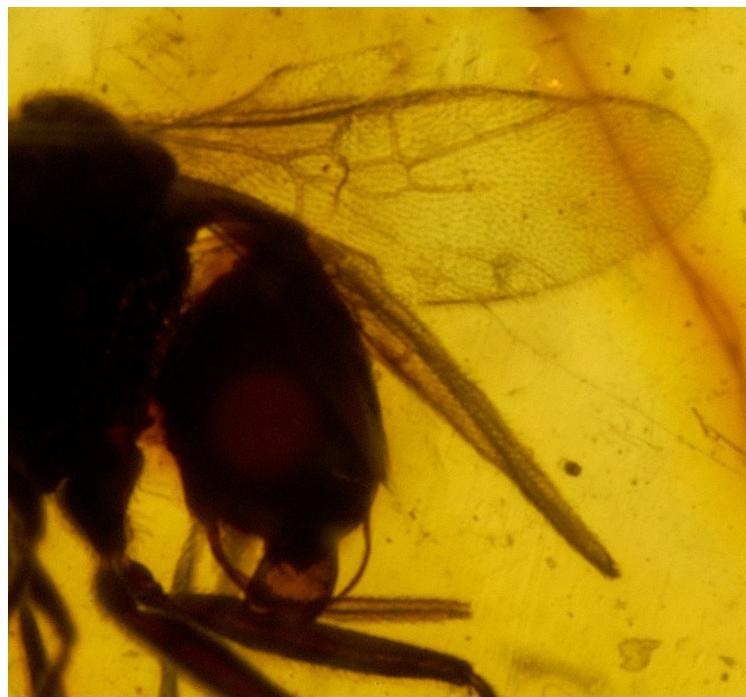


Fig. 4. Photomicrographic detail of forewing in holotype of *Sorellevania deansi* gen. et sp. n. (KU-NHM-ENT, Bu-058).

DISCUSSION

The Evanioidea has a relatively sparse fossil record. The earliest evidence of evanioids are species of the Praeaulacidae (= Anomopterellidae) from the Late Jurassic deposits of Karatau, Kazakhstan. The praeaulacids are likely not a monophyletic group but instead a stem group to Neoevanioides. In addition to the Jurassic of Karatau, praeaulacids are known from the Early Cretaceous of Australia (JELL & DUNCAN 1986; RASNITSYN 1990), China (ZHANG & ZHANG 2000), Siberia, and Mongolia (RASNITSYN 1990). The earliest evidence of the Neoevanioides comes from the Early Cretaceous and includes species of Esvaniidae (both primitive species of typical evaniids as well as the former families Cretevaniidae and Andreneliidae) from Asia and Europe, primitive species of the extinct gasteruptiid subfamily Kotujellinae, and the extinct, likely stem-group family Baissidae from Eurasia. It is possible that the Neoevanioides will be discovered from the latest Jurassic but it seems more likely that the group is of earliest Cretaceous origin and diversification occurred during the Cretaceous.

tion (Fig. 5). The evaniids certainly appear to have experienced a relatively early diversification as evidenced by the heterogeneity of Early Cretaceous amber genera (e.g., RASNITSYN 1975; BASIBUYUK et al. 2000b, 2002; DEANS et al. 2004; herein) as well as compressions of cretevaniines and the enigmatic *Andrenelia*. Admittedly all of these genera are relatively primitive by comparison to extant lineages, particularly *Mesevania*, *Lebanevania*, and *Andrenelia*, but their presence does indicate a relatively early radiation of taxa that can be generally assigned to Evaniidae with only slight expansion of the familial concept as we understand it from modern species. This is less true for the few Cretaceous representatives of Gasteruptiidae and Aulacidae, all of which belong to extinct subfamilies. Fossils of true Aulacinae are restricted to the Tertiary and fossils of “Eugasteruptiids” (i.e., Gasteruptiinae and Hyptiogastrinae) are not presently known in the geological record. Based on the geographical distribution of Gasteruptiinae and Hyptiogastrinae the two perhaps diverged sometime in the Late Cretaceous. Certainly extensive exploration remains for evanioid fossils not only throughout the Cretaceous (where taxa might be found to resolve relationships within the Neoevanioides and individual families) but also in the latest Jurassic, the latter hopefully shedding greater light onto the earliest evolution of the superfamily.

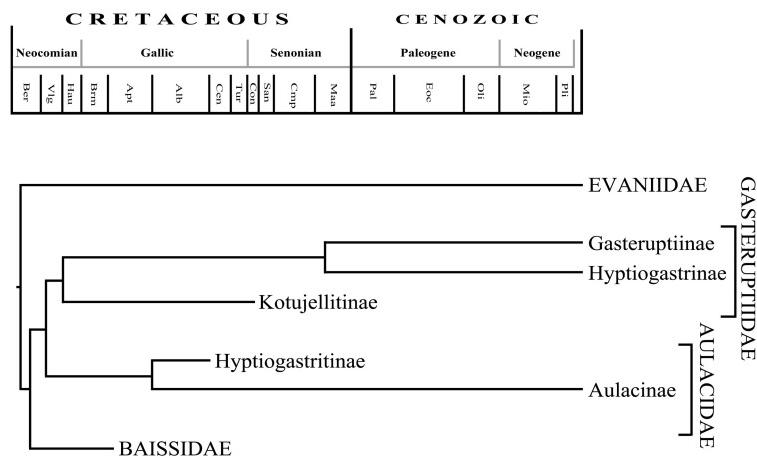


Fig. 5. Phylogeny of superfamily Evanioidea excluding the stem-group family Praeaulacidae (refer to GRIMALDI & ENGEL 2005 for discussion of clade support). The appendix (*vide infra*) summarizes the hierarchical classification of Evaniomorpha.

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APPENDIX

Hierarchical classification of infraorder Evaniomorpha, with emphasis on the Evanioidae (description of the various clades provided by GRIMALDI & ENGEL 2005). The following outline includes the new, extinct subfamily **Hyptiogastritinae** subf. n. of the evanioid family Aulacidae. The subfamily presently includes only the type genus, *Hyptiogasterites* COCKERELL (1917), which, like *Sorellevania* discussed above, is preserved in middle Cretaceous amber from Myanmar (JENNINGS et al. 2004). The new subfamily can be distinguished from other aulacid subfamilies by the following diagnostic combination of traits: primitive aulacids with complete occipital carina and with forewing 1rs-m, 2rs-m, and 2m-cu lacking.

Infraorder Evaniomorpha RASNITSYN 1980

Parvorder Megalyrones ENGEL 2005

Superfamily Megalyroidea SCHLETTTERER 1890

Parvorder Hypsisomata ENGEL 2005

Superfamily Evanioidea LATREILLE 1802

Family Praeaulacidae RASNITSYN 1972 (inclusive of Anomopterellidae)

Neoevanioidea tax. n.

Aulaciformes GRIMALDI & ENGEL 2005

Family Baissidae RASNITSYN 1975 (inclusive of Manlayinae)

Euaulacidae tax. n.

Family Aulacidae HEDICKE 1939

Subfamily Hyptiogastritinae subf. n. (*vide supra*)

Subfamily Aulacinae HEDICKE 1939

Family Gasteruptiidae ASHMEAD 1900 (conserved over Foenidae: ICZN, Art. 40.2)

Subfamily Kotujellinae RASNITSYN 1975

Subfamily Hyptiogastrinae CROSSKEY 1953

Subfamily Gasteruptiinae ASHMEAD 1900

Evaniiiformes GRIMALDI & ENGEL 2005

Family Evaniiidae LATREILLE 1802 (inclusive of Cretevaniidae and Andreneliidae)